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ScienceDirect

Energy Procedia 57 (2014) 2898 – 2903

Energy Procedia

2013 ISES Solar World Congress

The OmniluS project

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Abstract

With the continuous improvements in web technology, communications and computers (servers), many new low-cost and high-performance computer centers have been set-up which are able to store data and host applications that can be accessed through any-internet browser from any device like PCs, tablets or smartphones. This new approach is known as Cloud Computing or only just as the Cloud, and it has become a major innovation that is drastically changing the information and communication technologies (ICT) world.

A new web platform called OmniluS based on Cloud technology is here presented. OmniluS is designed to hold apps to support engineering in general, and the design, commercialization and maintenance of renewable heating and cooling (RHC) plants in particular. The OmniluS creators are much concerned with the need of automation and standarization of processes related to RHC engineering as a key aspect for a market break-through of this technology. Therefore, OmniluS apps are designed and distributed using a FSF approach, where FSF stands for Free, Simple and Fast.

This work presents a general overlook of the platform with some insight in the software structure, the databases, and applications already available both in stable or demo versions.

Selection and/or peer-review under responsibility of ISES.

Keywords: Cloud-Computing; Automation; Engineering; Planning; RHC

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doi:10.1016/j.egypro.2014.10.324

1. Introduction

Recent advances in the field of computational science have drastically changed the development and distribution of software. Desktop applications that have to be installed and updated by users are now being substituted by applications at the cloud programmed with a combination of different languages like PHP, SQL, Javascript, Ruby, Python…

Cloud applications are programs installed at remote computers available through internet browsers from any device like PCs, tablets or smartphones. Software is maintained by the development team at the remote computers and distributed automatically around the world through the internet. With this centralized software management, typical annoying problems for the user like constant updates or incompatibilities with their computer configuration are avoided. Therefore, the users can focus efforts on the use of the applications with no need of in-house ICT expertise. This results into an increased work production and efficiency. From the software developer side, the centralized approach also results into increased efficiency due to the simplified management of versions and the instantaneous distribution and communication with users.

This scenario gives promising opportunities for the renewable energies in general, and the green heating and cooling in particular. This sector is characterized by a relatively small market, and by small companies with limited development means. As a consequence, innovations take a long time, while a strong effort in automation, standardization and robust solutions is required in order to be able to compete with conventional-energy based systems. With the cloud, it is now possible to develop low-cost powerful and robust applications for the renewable heating and cooling world-wide market that will definitively contribute to standardization and automation.

The authors present a web platform called OmniluS designed to host applications to support market-oriented engineering, planning and maintenance tasks in the green heating and cooling sector. A beta version is already available at www.omnilus.com. The OmniluS goal is to provide technicians and installers with free, simple and fast tools that will allow them to prepare projects with no need of high technical skills, resulting into a reduction of installation costs and failures. The authors trust that this approach will be a break-through in the engineering field because it will open access of non skilled technicians to advanced engineering tools.

The platform consists of a user-friendly and multi-lingual interface (front-end), and a back-end with software packages and databases able to address technical design, commercial management and monitoring and maintenance of plants.

This work presents a general overlook of the platform with some insight in the software structure, the databases, and applications already available both in stable or demo versions.

2. The platform

OmniluS is designed to integrate in a single platform all means required for design, commercialization and maintenance of installations. A general approach is used that may allow to deal with any kind of installation. However, as main concern and experience of the developers is in the renewable heating and cooling field (RHC), first applications are being developed for this sector.

Figure 1 shows a scheme representing how OmniluS works. A set of software packages are installed in a server available through the internet. This is represented in the figure as a set of databases and apps inside a cloud. The users may sign-up and log-in through the web page www.omnilus.com using their own computer at any time and from any place. Once logged in the platform, the user has free access to a world of applications that will support him in the design, commercialization and maintenance tasks of

RHC plants. Some maintenance applications require the monitoring of data which is transferred to the OmniluS servers through the internet.

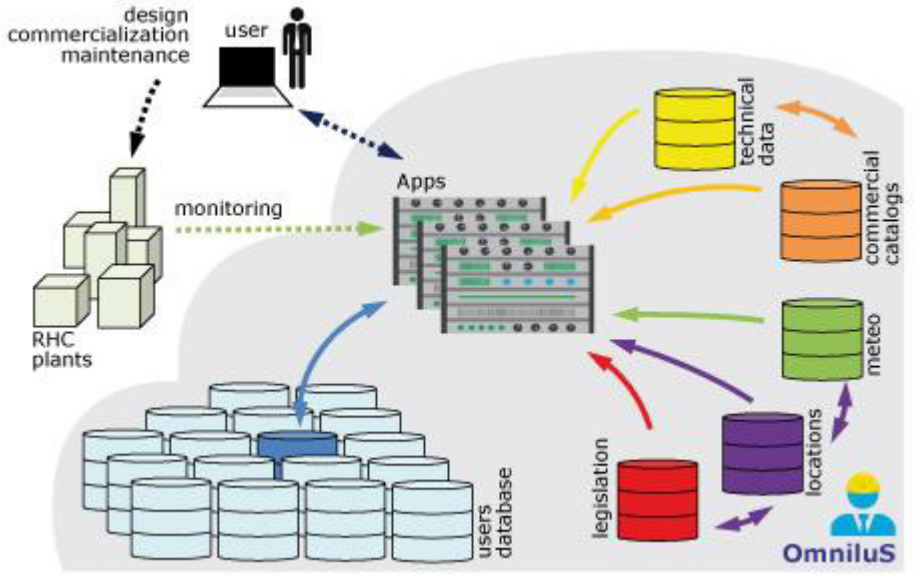

Fig. 1. The OmniluS layout.

2.1. Data bases

All databases required for the design, commercialization and maintenance of RHC plants are integrated in the platform. They are structured in 6 different databases

- *Technical data*
  A theoretical model is used for each component (i.e. solar collectors, heat exchangers, pumps, pipes, tanks, expansion vases, etc..). Technical information of the components are evaluated by skilled staff of the OmniluS team. The models parameters are then calculated and introduced in the technical data database. Therefore, when a component is selected by a user in a technical application, all technical data is already in the system. This avoids an important source of mistakes and also shorten data introduction time. For example, if a solar collector is selected to perform a calculation of a domestic water heating solar plant, all data of the efficiency curve, pressure drop and connections diameters are already introduced. Components models are adopted from the standard literature, e.g. [1][2], and may be steady, transient and 0 or multidimensional according to the modeling needs.

- *Commercial catalogs*
  A set of commercial catalogs is available in a database. All information necessary in the commercialization process is available: retail price, discounts, commercial name and reference,

description, provider, installation man-power required, small auxiliary components required for installation, etc. The commercial catalogs database is connected to the corresponding components in the technical data database. Therefore, once a component has been selected according to the design applications, budgets can automatically be set-up.

- *Locations*
  Main data of all towns around the world is included in a locations data bases. Data includes the country, province and town name, altitude, latitude and longitude.

- *Meteo*
  For each town in the location data base, meteorological data is collected and introduced in meteo database. Monthly averaged daily values of the main parameters are introduced. The criterion is to use those data according to the local legislation requirements when available, e.g. [3][4]. In other cases, data from free sources like RETScreen [5] are used.

- *Legislation*
  This database collects specific legal requirements to be accomplished according to local legislations, see for example [3][4].

- *Users data base*
  Each OmniluS user has its own data base in which particular data is safely and protectedly stored. These data includes profile information, customers, users (for those that sign-up as multiple user), applications files (input data and results from applications), discounts, commercial information of particular components, etc...

2.2. Apps

A first beta version of OmniluS was launched in mid 2012 including four apps. The platform and these four apps are already operative; however they are still under development and subjected to important updates that will include on-line help which currently is missing. Other applications are also available as demo versions ranging the following areas: i) Design of solar domestic water heating; ii) Solar outdoors pool heating; iii) Photovoltaics; iv) Renewable project cost analysis; v) Thermal loads analysis; vi) Geothermal and heat pumps, vii) Combined solar domestic hot water and heating. Different system models are used from transisent, to Users interested must email support@omnilus.com indicating their user name an areas in which are interested.

Hereafter in this section, the four applications already available are shortly described:

- *Meteo*
  Direct access to the content of the meteo database. It also allows the calculation of monthly averaged daily solar radiation on tilted surfaces. Standard calculation procedures are used [1].

- *Products*
  Management of the catalogs database. The user can activate and deactivate the catalogs to be used by the applications and determine the price discounts according to their own agreements with the provided of the components of the catalog. Additionally, particular commercial information of new components can also be defined. As the functionality of this app refers to the overall platform

configuration, in the following OmniluS upgraded expected by the last trimester of 2013 will be removed from the apps list and integrated in the configuration panel.

- *Budgets*
  Preparation of budgets for turn-key projects according to catalogs information and particular-user information. The project cost analysis includes components costs and discounts, installation costs (man-power), machinery costs, and profit margin. The budget information is stored in the user database, and can be downloaded as nice final pdf files to be delivered to the customer, or as doc or xls files for further documentation process. Details of this app are reported in the conference proceedings [6].

- *Shadows*
  Calculation of reduction of solar radiation on a collecting surface due to the effect of shadows of neighboring obstacles. Details of this app are reported in the conference proceedings [7].

3. The FSF approach: Free, Simple and Fast

Advanced tools for RHC systems are well established and widely used like Trnsys [8], T-Sol [9], Meteonorm [10] and Presto [11] among many others. They are commercial software with licenses fees. Additionally, they may be used by skilled technicians, and typically need significant time. In large enough or demonstration-like projects, these costs can perfectly be assumed, and therefore, the use of these tools is a good option.

However, in small-size projects or in standardized projects, the cost is too significant, and may drastically contribute into the none cost-efficiency of the RHC systems with respect to the standard systems. Additionally, the market of the small-size energy production systems, let's say projects with a nominal power below a few hundreds of kW, are usually commercialized, designed, run and maintained by small SMEs or professionals like plumbers and electricians, with constrained profit margins and low engineering skills. Therefore, the use of advanced tools is normally out of their scope.

OmniluS mainly focuses on giving response to the huge demand of software tools for small size systems market by providing Free, Simple and Fast applications. This approached is so-called as the FSF approach.

4. The software

The OmniluS platform is structured in two main parts: the front-end and the back-end. The front-end is the user interface. It is a web-program that combines the use of several programming languages and free software packages like HTML5 [12] Javascript and ExtJS [13] .

The back-end is the software that performs calculations and reports. It consists of a set of software-packages running on linux operation system [14] programmed mainly in SQL[15], Python [16] and C++ [17] using the Object Oriented approach. The back-end makes use of free-software packages. Among others: GNU scientific library gsl [18] for technical detail calculations and mathematical algorithms, the graphics layout engine gls [19] for plots and the document preparation system latex [20],

The internal communication between the front and back end is carried out by means of XML files [21].

5. What next

After several years of development, the first beta version of OmniluS was launched in 2012. It is the first cloud platform designed to integrate all tools required for design, commercialization and maintenance of not only renewable heating and cooling plants, but also for any engineering project.

Furthermore, OmniluS is based on the called FSF (Free Simple and Fast) approach. The cloud concept together with the FSF-approach will introduce a new revolutionary scenario, that will drastically simplify engineering work, reduce office-project time and minimize it cost.

OmniluS is only in a very first early stage and expects to grow worldwide and with many other cloud-apps. To do so, OmniluS is searching open collaboration with other professionals, companies and groups worldwide.

6. Acknowledgements

This work has partially been supported by the Spanish Ministerio de Ciencia e Innovación (project reference ENE 2010-18994).

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